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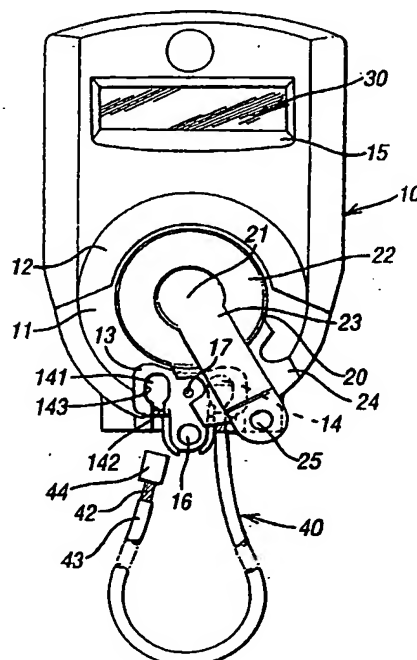
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(54) Abstract Title
Security seal device with detachable cable display indicating reopening

(57) A sealing device comprises a housing 10 and a cable 40 for attaching to cargo containers to check for unauthorised opening of the container. The cable 40 is part of a sealing member 42 which has at its ends, enlarged heads 44 which are fitted into sockets 14 preferably by passing through an aperture 141 and applying a translation and rotation (see figure 7). A sealing cover 20 is moved over the socket 14, preferably by rotation, to close the seal member ends 44 in the housing sockets 14. A detector records if the sealing member is moved from a closed to an open position. The detector preferably commands a random number generator to display a new number in display 30, so that the opening action is indicated. The sealing member 42 may complete a sensor circuit when attached to the housing. The device may have communication means to a remote device and alarm means. In addition to detecting opening, the device may detect tampering with the sealing member.

FIG. 4A



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SEAL

5 The invention is in the field of sealing devices, and in particular electronic sealing devices for sealing compartments and for indicating whether a sealed compartment has been opened. The invention further relates to security devices in general as well as to devices for detecting the integrity of sealed containers.

10 As global commerce and the trade in commodities increase the rate of crime such as theft and smuggling also increases. In the growing global market goods produced at one location are often destined for other parts of the world. Transportation of these goods occurs via a number of different means and may require crossing many borders before the goods reach their final destination. It is not unusual for a consignment of goods to be loaded into a sealed cargo
15 container at the place of manufacture and then to be transported via road, rail and sea to the location of the recipient, where the seal is broken and the goods are unloaded.

20 It is essential that the manufacturer or haulier can guarantee that the goods reach their final destination intact and untampered. The integrity of the cargo is especially important when goods constitute luxury products or are of hi-tech nature, since the black market value of such merchandise can be considerable. There is often a much greater risk of a small proportion of goods being lifted from each cargo consignment than there is of the whole consignment being
25 stolen.

It is, therefore, apparent that there is a need for a means of guaranteeing the integrity of sealed areas, and in particular the integrity of sealed containers or cargo bays used for the transport of goods. There is a further need for
30 identifying when a sealed area or compartment has been subjected to an authorised or unauthorised entry, and preferably when and where such an entry occurred.

A known sealing device for recording entry into a controlled area via a door or other closure member, is described in EP-A-0193297. The device comprises a housing in which a detector is located. The housing is typically attached to the closure member via a sealing cable threaded through a lock on the closure member and then inserted into a receiver in the housing where it is held in place by a rotating knob. The detector generates a random number every time the knob is rotated to secure or release the cable, and the number is shown on an LED display on the housing. In this way an enclosed area can be sealed, a new random number generated and noted and then when the area is due to be legitimately reopened the number rechecked. If in the meantime an unauthorised entry has occurred a new random number will be shown on the display.

Electronic seals such as the one described in EP-A-0193297 are typically used for sealing doors on containers and to warehouses as well as the rear doors of trailers, lorries and trucks.

WO-A-96/24920 describes a mechanical sealing device that operates by a spring loaded striker flipping a set of wheels carrying display indices every time the seal is opened or closed. The striking of the wheels causes them to rotate and thereby generate a random number for recordal by the operator. As is common with mechanical devices, such seals suffer from exposure to the environment and can become jammed due to ingress of grime and dirt. The mechanical apparatus within the seal of WO-A-96/24920 may also be vulnerable to tampering.

It is apparent that due to the valuable nature of goods located in secured areas or transported in containers and in trucks, there is a high associated risk of third party tampering with the devices used to seal these areas and compartments. It is therefore desirable to provide a seal that can be reliably reused and which has resistance to tampering.

It is an object of the present invention to overcome or ameliorate deficiencies

present in the art. In particular, it is an object of the invention to provide a sealing device that has improved resistance to tampering and is therefore more reliable. A further object is to provide an improved multiple utility sealing device.

5 In a first aspect, the invention provides for a sealing device comprising:

a housing comprising a socket for receiving an end of a sealing member, said sealing member having an end with a enlarged head;

10 said housing further comprising a sealing cover moveable between an open configuration in which the end can be inserted into or removed from the socket and a closed configuration in which the end can not be inserted into or removed from the socket; and

15 a detector for recording if the sealing cover is displaced from the closed configuration;

20 wherein the socket is such that, with the sealing cover in an open configuration and the end of the sealing member outside the socket, to locate the end of the sealing member in the socket and move the sealing cover to the closed configuration so as to secure the end of the sealing member in the socket, requires a rotational movement and a linear movement of the end.

25 Thus, the socket and the sealing cover are arranged to necessitate this particular mode of insertion and removal of the sealing member into and out of the socket, and are of significant advantage in providing a secure engagement between the sealing member and the housing. There is reduced access to the enlarged head and thus the opportunity to tamper with the seal is reduced.

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In a preferred device, engaging the sealing member with the housing requires a linear translocation followed by a longitudinal rotation, most preferably where

the longitudinal rotation is about the end of the sealing member.

To securely locate the enlarged head of the sealing member in a preferred socket, the socket is designed so that it comprises:

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a wide portion; and

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a narrow portion, the narrow portion having a diameter less than that of the enlarged head, such that when the sealing member is located within the socket the enlarged head sits within the wide portion and the sealing member rests in the narrow portion.

A typical sealing device is fitted with at least one socket having features as follows:-

15

a chamber is located on or towards the edge of the housing at the junction of first and second faces (i.e. on an edge of two faces), which chamber is of sufficient size to accommodate the enlarged head;

20

the chamber has an entrance which comprises,

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(1) a wide portion that is of a diameter sufficient to accept longitudinal insertion of the enlarged head but not lateral insertion of the enlarged head, which wide portion is located on a first face; and

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(2) a narrow portion that is of a diameter less than that of the enlarged head but sufficient to accept the sealing member, which narrow portion extends from the wide portion on the first face onto the second face, such that it effectively defines a slot in the side of the housing that extends from the first face to the second face.

To locate the end of the sealing member in the socket requires a linear translocation into the recess through the wide portion of the entrance, followed by a longitudinal rotation about the enlarged head of the sealing member, such that the sealing member lies in the narrow portion. The sealing cover is then moved to the closed position.

Transverse movement of the enlarged head will not then effect release as the diameter of the wide portion is less than that of the enlarged head and the head can not be turned to allow its release when the sealing cover is in the closed position.

The entrance to the chamber is preferably reinforced with a plate, typically a metal plate.

The sealing member is typically a cable such as a steel cable. Although, any elongate member would be suitable, e.g. a chain with a rod at its terminus. The enlarged head is typically obtained by adding a ferruled cap to the end of a cable - e.g. a Bowden cable or terminally crimped cable. An enlarged end can be incorporated into the moulding during manufacture when the sealing member is a rod-like structure.

In a preferred embodiment, the sealing device further comprises a means of display mounted on the housing. In specific embodiments where the display is for representation of alphanumeric information, an LED, LCD or other electronic display is typically used. In alternative embodiments, a light or LED is suitably used as the display.

In an example of the invention in use, the sealing device includes a detector that includes a random number generator which is activated each time the sealing cover is displaced from the closed configuration. The output from the random number generator is shown on the display, optionally permanently and

optionally upon interrogation by a user, and can therefore be noted down each time the seal cover is displaced.

5 In a preferred embodiment of the invention, the detecting means is an electronic detector and comprises an integral power source. In one example, the detector is linked to a microswitch which is triggered by movement of the sealing cover.

10 The detector means can suitably also comprise further components that contribute to the amount of recordable information contained within and displayed by the seal. For example the detector can include an audio alarm that sounds when the sealing cover is displaced from the closed configuration.

15 In a further embodiment, the detector comprises a timing device such as a clock. The timer can function in two ways, firstly it can simply display the time and date and record that exact time when the seal is opened and closed. Secondly, the timer can record the days, hours and minutes since the seal was closed, the timer being reset to zero every time the seal is opened.

20 A second aspect of the invention provides for a sealing device comprising:

a housing, comprising a socket adapted to engage a sealing member;

25 a sealing cover, which is moveable between a closed configuration in which it prevents removal or insertion of the sealing member, and an open configuration in which it permits insertion and removal of the sealing member; and

30 detecting means for detecting when the sealing member is displaced from the closed configuration.

In a preferred embodiment the sealing cover is mounted on the housing such that at least the initial direction of movement of the sealing cover away from the

closed configuration is substantially transverse to the longitudinal axis of the sealing member. Typically, the transverse direction of movement will be substantially perpendicular to the longitudinal axis of the sealing member. This arrangement is of particular advantage in that activation of the detector can occur after an initial movement of the sealing cover and before access to the socket or to the sealing member within the socket is enabled by a further movement of the sealing cover.

It is preferred that the detector be calibrated such that it be activated before the sealing cover is displaced sufficiently to allow access to the junction between the enlarged head and the sealing member. This is a further security feature intended to prevent undetected tampering occurring.

A third aspect of the invention provides for a sealing device comprising the following components:-

a housing, comprising a plurality of sockets adapted to engage a plurality of sealing members;

a sealing cover, which when in (1) a closed configuration closes all of the sockets preventing removal or insertion of the sealing members, (2) a selectively open configuration permits insertion and removal of one or more of the sealing members from at least one but not all of the sockets, or (3) a fully open configuration permits insertion and removal of the sealing members from all of the sockets; and

detecting means for detecting when the sealing member is displaced from the closed configuration.

By providing a plurality of sockets, and a plurality of fully and partly open positions for the sealing cover, a single seal can control and/or monitor a plurality of compartments or provide greater flexibility in relation to a single

compartment. The combination of varying open and closed configurations can be recorded by the detector providing further information about the history of usage of the seal. In a preferred embodiment, the sealing device comprises two sockets.

5 The detecting means can be activated each time the sealing cover is displaced from the closed, selectively open and fully open configurations. Alternatively, the detecting means can be differentially activated when the sealing cover is displaced to the left or right of the sockets.

10 In a further embodiment of the invention where the housing comprises a first and a second socket, the detecting means is differentially activated when (1) both sockets are covered, (2) the first socket is covered and the second socket is open, (3) the first socket is open and the second socket is covered, and (4)
15 both sockets are open.

A fourth aspect of the invention provides for a sealing device comprising:

20 a housing, comprising a socket adapted to engage a sealing member;

a sealing cover, which when in the closed configuration prevents removal or insertion of the sealing member, and when in the open configuration permits insertion and removal of the sealing member;

25 detecting means for detecting when the sealing member is displaced from the closed configuration and also if an attempt is made to displace or remove the sealing cover from the housing.

A fifth aspect of the invention provides a sealing device comprising:

30 a sealing member comprising a conductor means running the length of the sealing member; and

a housing comprising means for engaging the end of the sealing member, and further comprising detector means and display means;

5 wherein when the sealing member engages the housing, a sensor circuit is completed such that breach of the sensor circuit is detected by the detector means and is displayed via the display means.

10 In a preferred embodiment the invention comprises an active cable as the sealing member. The active state is provided by a sensor circuit that runs the length of the cable and is completed by the interface of cable and housing. Thus, if the seal is opened or if the cable is broken at any point the detector identifies this as a breach of seal integrity.

15 The sensor circuit can be based on a number of technologies, but is typically selected from electrical; electronic; optoelectronic; magnetic; and radio frequency systems.

20 In order to facilitate completion of the sensor circuit by interface between the housing and the sealing member, there can be a plug on the sealing member and a corresponding socket on the housing, or vice versa.

25 In preferred embodiments, an electrical or electronic circuit runs the length of the cable. A sensor in the detector means in the housing either continually or intermittently senses the resistance of the circuit. If the circuit is breached, for example by cutting the cable or opening the seal, the detector is activated and the breach recorded accordingly.

A sixth aspect of the invention provides for a sealing device comprising:

30 at least one sealing member comprising an enlarged end; and

a housing comprising means for engaging the end of at least one sealing

member, and further comprising detector means, display means and means for external communication with a remote apparatus.

5 The means for external communication is typically selected from at least one of the following systems: a radio frequency (RF) transmitter/receiver; a microwave transmitter/receiver; an infra-red (IR) transmitter/receiver; an electronic interface; and an optoelectronic interface.

10 In an example of the invention in use, the seal comprises an RS25485 port enabling RF telemetry with a remote computer, typically an onboard computer in a truck.

15 In a preferred embodiment, the remote apparatus is selected from a computer; a global positioning system (GPS); a timing device; a data recorder; an alarm; an identity verification system (e.g. a swipe card reader or key pad); and a payment verification system.

20 It is optional for the seal to communicate with a GPS remote from the seal, say in the cab of a truck on which the seal is located, or alternatively the housing of the seal can comprise GPS locator device itself. The GPS allows the seal to be tracked by a external monitor, such as the home base of the haulier. The GPS can be further integrated with the detector means such that the location where the seal is opened can be logged, thus adding a further tier of security to the effectiveness of the seal.

25 It is further optional for the seal to communicate with remote sensors positioned in and around the vicinity of the sealed compartment. In one example of the invention in use, a seal of the invention is located on a truck and is in RF communication with a remote sensor located on the trailer doors. Thus, the seal records opening and closing of the trailer doors via the remote sensor in addition
30 to the seal monitoring its own integrity. The remote sensor can also be located elsewhere on a truck, for example in the cabin or in the engine and can

therefore be used to monitor other variables that might influence the security of a sealed compartment. It is further optional for the seal to be directly linked to the remote sensor via an electrical, electronic or optoelectronic interface.

5 In a preferred embodiment, the seal is programmable such that it can only be legitimately opened in a predetermined location. Combination of the seal with a GPS and an identity verification device enables such an arrangement and thus provides for extremely high levels of security to be achieved.

10 Further preferred seals utilise some or a combination or all of the features described in the aforementioned aspects.

The invention further provides for a method for operating a seal such as those described in detail above or in the specific embodiment below. The method
15 comprises:

inserting the end of the sealing member into the socket;

20 rotating the sealing member through an axis transverse to the axis of insertion in order to securely locate the end of the sealing member in the socket; and

moving the sealing cover into the closed configuration thereby completing the seal.

25

A specific embodiment of the invention is shown in the accompanying drawings in which:

30 Fig. 1 shows a front view of a seal with the sealing cover in the closed configuration;

Fig. 2 shows a further front view of the seal with the sealing cover in a

half open configuration, allowing removal of one sealing member;

Fig. 3 shows a further front view of the seal with the sealing cover in a fully open configuration, allowing removal of both sealing members;

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Fig. 4A shows an enlarged front view of the seal with one socket engaged with a sealing member and one socket vacant;

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Fig. 4B shows a section along line IVB with the sealing member engaged in the socket;

Fig. 4C shows the plate in isolation from the housing;

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Fig. 4D shows how the plate and sealing cover are assembled into the housing;

Fig. 5 shows a side view of the seal;

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Fig. 6 shows a bottom view of the seal with sealing members engaged in both sockets;

Fig. 7 shows a perspective view of the seal, and indicates the mode of engagement of an enlarged head of the sealing member with the socket; and

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Fig. 8 shows an alternative perspective view of the seal from a reverse angle, with both sealing members engaged.

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Referring to all figures, the body of the seal comprises a housing (10) on which is rotatably mounted a sealing cover (20) having an arm (23). The housing (10) also comprises a socket (14) which receives an enlarged head (44) of a sealing member (40). Briefly, movement of the sealing cover between a closed position in which the enlarged head (44) is secured in the housing and an open position

in which it can be removed from the housing triggers generation of a signal that the seal has been opened.

5 The housing has detecting means for determining when the sealing cover (20) is moved. The detecting means comprises an electronic circuit that generates a random number every time the sealing cover (20) is moved between open and closed positions. The random number is shown on a display (30) located in a recess (15) on the front of the housing (10) (Fig.1).

10 The socket (14) is adapted to receive the enlarged end (44) of the sealing member (40). Entry to the socket (14) is via an aperture (141) in the plate (13). The aperture (141) comprises a wide portion (143) and a narrow neck-like portion (142) which extends from the front to the bottom of the seal.

15 The sealing member (40) is a cable with an enlarged end or head (44) which is wider in diameter than the body of the sealing member (40).

20 The sealing cover (20) is rotated along the track (11) in order to open or close the socket (14). When the sealing cover (20) lies over the socket (14) it is in the closed configuration. When the socket (14) is uncovered by the sealing cover (20), the sealing cover (20) is in the open configuration and it becomes possible to move the end of the sealing member into and out of the socket. In the embodiments of the invention illustrated the seal comprises two sockets (14) for receiving respective ends a sealing member (40). If one socket (14) is closed and one socket (14) is open the sealing cover (20) is said to be in a partially open configuration.

30 The sealing cover (20) comprises a central boss (21) which is pivotally mounted on the housing (10). Extending away from the boss (21) to the periphery of the track (11) is at least one arm (23). The arm (23) serves to lie over and obstruct the socket (14) when in the closed configuration, and may also provide a handle in order to facilitate rotation of the sealing cover (20). In a preferred

embodiment of the invention the arm (23) comprises lateral projections (24) which further cover the socket (14) when the cover (20) is in the closed configuration. The lateral projections (24) are slightly smaller in size than the size of the aperture (141), thereby allowing partial visual inspection of the socket (14) and the tip of the enlarged end (44) even when the sealing cover (20) is in the closed configuration.

The sealing member (40) can only be inserted and removed from the socket (14) when the sealing cover (20) is in the open configuration - i.e. when the aperture (141) is completely unobscured by the sealing cover (20). The sealing member (40) engages the socket (14) via an interaction that requires the sealing member (40) be moved in at least two planes (Fig. 7).

To engage the sealing member (40) and subsequently complete the seal, the enlarged head (44) of the sealing member (40) is firstly inserted through the wide portion (143) of the aperture (141) into the socket (14). This insertion is typically in a direction perpendicular to the body of the housing (10) and is illustrated by the solid part of Figure 7. With the enlarged head (44) located within the socket (14), the sealing member (40) is then rotated through an angle transverse to the axis of insertion, such that the neck of the cable (42) of the sealing member (40) lies in the groove formed by the narrow portion (142) of the aperture (141), and is illustrated by the dotted lines in Figure 7. The sealing cover (20) can then be placed in the closed configuration completing the seal. The enlarged head (44) is wider in diameter than the width of the narrow portion (142) and cannot be removed from the housing by pulling it through this narrow portion (142). Further, as the narrow portion (142) extends to the front of the seal, to remove the enlarged head requires rotational movement of the sealing member and then a linear movement.

Removal of the sealing member (40) from the seal requires the opposite process to that for insertion. Firstly, the sealing cover (20) must be moved to the open configuration thus breaking the seal and triggering electronics of the seal to

record opening of the seal. The sealing member (40) is then rotated into an erect position out from the groove of the narrow portion (142). Next, the enlarged head (44) of the sealing member (40) is completely withdrawn from the socket (14).

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Thus, in order to securely engage the sealing member (40) with the socket (14) and allow completion of the seal, the sealing member (40) must be both inserted and then rotated before the sealing cover can be closed and the seal completed.

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It is an advantage of the present seal that by requiring movement through two planes, the sealing member (40) and socket (14) have improved resistance to tampering. Further, the enlarged head (44) can only be removed from the socket (14) by displacing the sealing cover (20) from the closed configuration and thus the seal is always broken when the sealing member (40) is inserted or removed from the socket (14).

15

The arm (23) of the sealing cover (20) is perforated with a bore (25) at the end furthest from the boss (21). The plate (13) also comprises a bore (16) of equivalent diameter, that aligns with the bore (25) when the sealing cover (20) is in the closed configuration. This alignment of the bores (16,25) allows for a locking means to be passed through them to further secure the sealing cover (20) in the closed configuration, thereby preventing accidental displacement of the sealing cover and thus breaking of the seal. Typical locking means for securing the seal include simple toggles or pegs to padlocks, D-locks, chain and/or cable locks.

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A further feature of the illustrated embodiment of the invention is that displacement of the sealing cover (20) from the closed configuration triggers a microswitch located beneath the sealing cover (20). Triggering the microswitch causes activation of a random number generator electronic circuit located within the housing (10). The output of the random number generator is shown on the

display (30). Since the sequence of numbers generated by this system is unpredictable the security of the seal is high.

The display (30) is an LCD display. It is adapted to show simple information such as an alphanumeric character.

List of parts:

	10	Housing
	11	track
	12	lip
5	13	plate
	14	socket
	141	aperture of socket 14
	142	narrow portion of aperture 141
	143	wide portion of aperture 141
10	15	recess
	16	bore
	17	hole
	20	sealing cover
15	21	boss
	22	face
	23	arm
	24	projection
	25	bore
20	30	display
	40	sealing member
	42	cable
25	43	sleeve
	44	enlarged head

CLAIMS:

1. A sealing device comprising:

a housing comprising a socket for receiving an end of a sealing member, said sealing member comprising an end with an enlarged head;

said housing further comprising a sealing cover moveable between an open configuration in which the end can be inserted into or removed from the socket and a closed configuration in which the end can not be inserted into or removed from the socket; and

a detector for recording if the sealing cover is displaced from the closed configuration;

wherein the socket is such that with the sealing cover in an open configuration and the end of the sealing member outside the socket, in order to locate the end of the sealing member in the socket and move the sealing cover to the closed configuration so as to secure the end of the sealing member in the socket, requires a rotational movement and a linear movement of the end.

2. A device according to claim 1, wherein location of the end of the sealing member in the socket requires a linear translocation followed by a longitudinal rotation.
3. A device according to claim 2, wherein the longitudinal rotation is about the end of the sealing member.
4. A device according to any previous claim, wherein the socket comprises:

a wide portion; and

a narrow portion, the narrow portion having a diameter less than that of the enlarged head, such that when the sealing member is located within the socket the enlarged head sits within the wide portion and the sealing member rests in the narrow portion;

wherein removal of the sealing member from the socket requires first a longitudinal rotation about the enlarged head before a linear translocation can occur.

5. A device according to claims 1-3, wherein the socket comprises:

a chamber located on the edge of the housing at the junction of first and second faces, which chamber is of sufficient size to accommodate the enlarged head; and

the chamber has an entrance which comprises,

(1) a wide portion that is of a diameter sufficient to accept longitudinal insertion of the enlarged head but not lateral insertion of the enlarged head, which wide portion is located on a first face; and

(2) a narrow portion that is of a diameter less than that of the enlarged head but sufficient to accept the sealing member, which narrow portion extends from the wide portion on the first face onto the second face;

wherein location of the end of the sealing member in the socket requires a linear translocation into the chamber through the wide portion, followed by a longitudinal rotation about the enlarged head of the sealing member, such that the sealing member lies in the narrow portion.

6. A sealing device according to any previous claim wherein the sealing member is a cable.
7. A sealing device according to any previous claim further comprising a display mounted on the housing.
8. A sealing device according to claim 7, wherein the display is selected from an LED or an LCD display.
9. A sealing device according to any previous claim wherein the detector comprises a random number generator which is activated each time the sealing cover is displaced from the closed configuration, and which number is shown on the display.
10. A sealing device according to any previous claim wherein said detecting means is an electronic detector.
11. A sealing device comprising:
 - a housing, comprising a socket adapted to engage a sealing member;
 - a sealing cover, which when in the closed configuration prevents removal or insertion of the sealing member, and when in the open configuration permits insertion and removal of the sealing member; and
 - detecting means for detecting when the sealing member is displaced from the closed configuration.
12. A sealing device according to any previous claim wherein the sealing cover is rotatably mounted on the housing.
13. A sealing device according to claim 12, wherein the initial direction of

movement of the sealing cover away from the closed configuration is substantially transverse to the longitudinal axis of the sealing member.

14. A sealing device according to claim 12, wherein the direction of movement of the sealing cover is perpendicular to the longitudinal axis of the sealing member.

15. A sealing device according to claims 11-14, wherein the socket comprises:
a wide portion; and

a narrow portion, the narrow portion having a diameter less than that of the enlarged head, such that when the sealing member is located within the socket the enlarged head sits within the wide portion and the sealing member rests in the narrow portion;

wherein the detecting means is activated after the sealing cover is displaced from the closed configuration but before the narrow portion of the socket is uncovered.

16. A sealing device according to any of claims 11-15, wherein the detecting means is activated before the sealing cover is displaced sufficiently to allow access to the junction between the enlarged head and the sealing member.

17. A sealing device according to any of claims 11-16, wherein the sealing member is a cable.

18. A sealing device according to any of claims 11-17 wherein the housing comprises one or more component selected from the group consisting of a random number generator; an alarm; a timing device; a display; and an LED.

19. A sealing device according to any previous claim wherein movement of the

sealing cover away from the closed configuration actuates a microswitch thereby activating the detector.

20. A sealing device comprising:

a housing, comprising a plurality of sockets adapted to engage a plurality of sealing members;

a sealing cover, which when in (1) a closed configuration closes all of the sockets preventing removal or insertion of the sealing members, (2) a selectively open configuration permits insertion and removal of one or more of the sealing members from at least one but not all of the sockets, or (3) a fully open configuration permits insertion and removal of the sealing members from all of the sockets; and

detecting means for detecting when the sealing member is displaced from the closed configuration.

21. A sealing device according to claim 20, comprising two sockets.
22. A sealing device according to claim 20, wherein the detecting means is activated each time the sealing cover is displaced from the closed, selectively open and fully open configurations.
23. A sealing device according to claims 20-22, wherein the detecting means is differentially activated when the sealing cover is displaced to the left or right of the sockets.
24. A sealing device according to claim 21, comprising a first and second socket wherein the detecting means is differentially activated when (1) both sockets are covered, (2) the first socket is covered and the second socket is open, (3) the first socket is open and the second socket is covered, and (4) both

sockets are open.

25. An electronic seal according to claims 20-24 further comprising means for recording time and duration of the sealing cover in each of the closed and open positions.

26. A sealing device comprising:

a housing, comprising a socket adapted to engage a sealing member;

a sealing cover, which when in the closed configuration prevents removal or insertion of the sealing member, and when in the open configuration permits insertion and removal of the sealing member;

detecting means for detecting when the sealing member is displaced from the closed configuration and also if an attempt is made to displace or remove the sealing cover from the housing.

27. A sealing device comprising:

a sealing member comprising conductor means running the length of the sealing member; and

a housing comprising means for engaging the end of the sealing member, and further comprising detector means and display means;

wherein when the sealing member engages the housing a sensor circuit is completed such that breach of the sensor circuit is detected by the detector means and is displayed via the display means.

28. A sealing device according to claim 27, wherein the sealing member comprises a cable.

29. A sealing device according to claims 27 and 28 wherein the sensor circuit comprises a circuit selected from the group consisting of electrical; electronic; optical electronic; magnetic; and radio.
30. A sealing device according to any of claims 27-29, wherein the means for engaging the end of the sealing member with the housing comprises a plug and a socket.
31. A sealing device according to claims 27-30, further comprising a sealing cover, which when in (1) a closed configuration covers the socket preventing removal or insertion of the sealing member, and (2) a fully open configuration permits insertion and removal of the sealing member from the socket;

wherein the detecting means further detects when the sealing member is displaced from the closed configuration.

32. A sealing device according to claim 31, wherein with the sealing cover in an open configuration and the end of the sealing member outside the socket, to locate the end of the sealing member in the socket and move the sealing cover to the closed configuration so as to secure the end of the sealing member in the socket, requires a rotational movement and a linear movement of the end.
33. A sealing device according to claim 32, wherein location of the end of the sealing member in the socket requires a linear translocation followed by a longitudinal rotation.
34. A sealing device according to claim 33, wherein the longitudinal rotation is about the end of the sealing member.
35. A sealing device according to claim 34, wherein the sealing member

comprises a cable.

36. A sealing device comprising:

at least one sealing member comprising an enlarged end; and

a housing comprising means for engaging the end of at least one sealing member, and further comprising detector means, display means and means for external communication with a remote apparatus.

37. A sealing device according to claim 36, wherein said means for external communication is selected from at least one of the group consisting of a radio frequency (RF) transmitter/receiver; a microwave transmitter/receiver; an infra-red (IR) transmitter/receiver; an electronic interface; and an optoelectronic interface.

38. A sealing device according to claims 36 and 37, wherein the means for engaging the end of the sealing member comprises a socket.

39. A sealing device according to claim 38, further comprising a sealing cover, which when in (1) a closed configuration covers the socket preventing removal or insertion of the sealing member, and (2) a fully open configuration permits insertion and removal of the sealing member from the socket;

wherein the detecting means further detects when the sealing member is displaced from the closed configuration.

40. A sealing device according to claim 39, wherein with the sealing cover in an open configuration and the end of the sealing member outside the socket, to locate the end of the sealing member in the socket and move the sealing cover to the closed configuration so as to secure the end of the sealing

member in the socket, requires a rotational movement and a linear movement of the end.

41. A sealing device according to claim 40, wherein location of the end of the sealing member in the socket requires a linear translocation followed by a longitudinal rotation.
42. A sealing device according to claim 41, wherein the longitudinal rotation is about the end of the sealing member.
43. A sealing device according to any of claims 36-42, wherein the remote apparatus is selected from the group consisting of a computer; a GPS; a timing device; a sensor; a data recorder; an alarm system; an identity verification system; and a payment verification system.
44. A method for operating a seal according to any previous claim comprising:

inserting the end of the sealing member into the socket;

rotating the sealing member through an axis transverse to the axis of insertion in order to securely locate the end of the sealing member in the socket; and

moving the sealing cover into the closed configuration thereby completing the seal.



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E2A AAB ACXX

Int Cl (Ed.7): G08B 13/06 G09F 3/03 E05B 39/00 39/04 45/00

Other: Online : WPI JAPIO EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A, E	EP 1063627 A2	See especially abstract and figures	
A	EP 0978812 A2	(HI G TEK) See especially abstract and figures	
X	EP 0618559 A2	(ENCRYPTA) See whole document	11
X	EP 0413065 A1	(DATATOOL) See figures and abstract	11, 18
X, Y	EP 0193297 A1	(ENIGMA) See whole document especially figures 1 and 2 and pages 9 and 10.	X: 11- 19 Y:1
X	WO 96/24920 A1	(MECOM)	11, 16-18
Y	US 5887486	(LIN AH PING) see figures	1
Y	JP 080312726 A	(FUJI) See figures, Derwent abstract acc. No. 1997-063205 and PAJ abstract	1

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E Patent document published on or after, but with priority date earlier than, the filing date of this application.

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FIG. 1

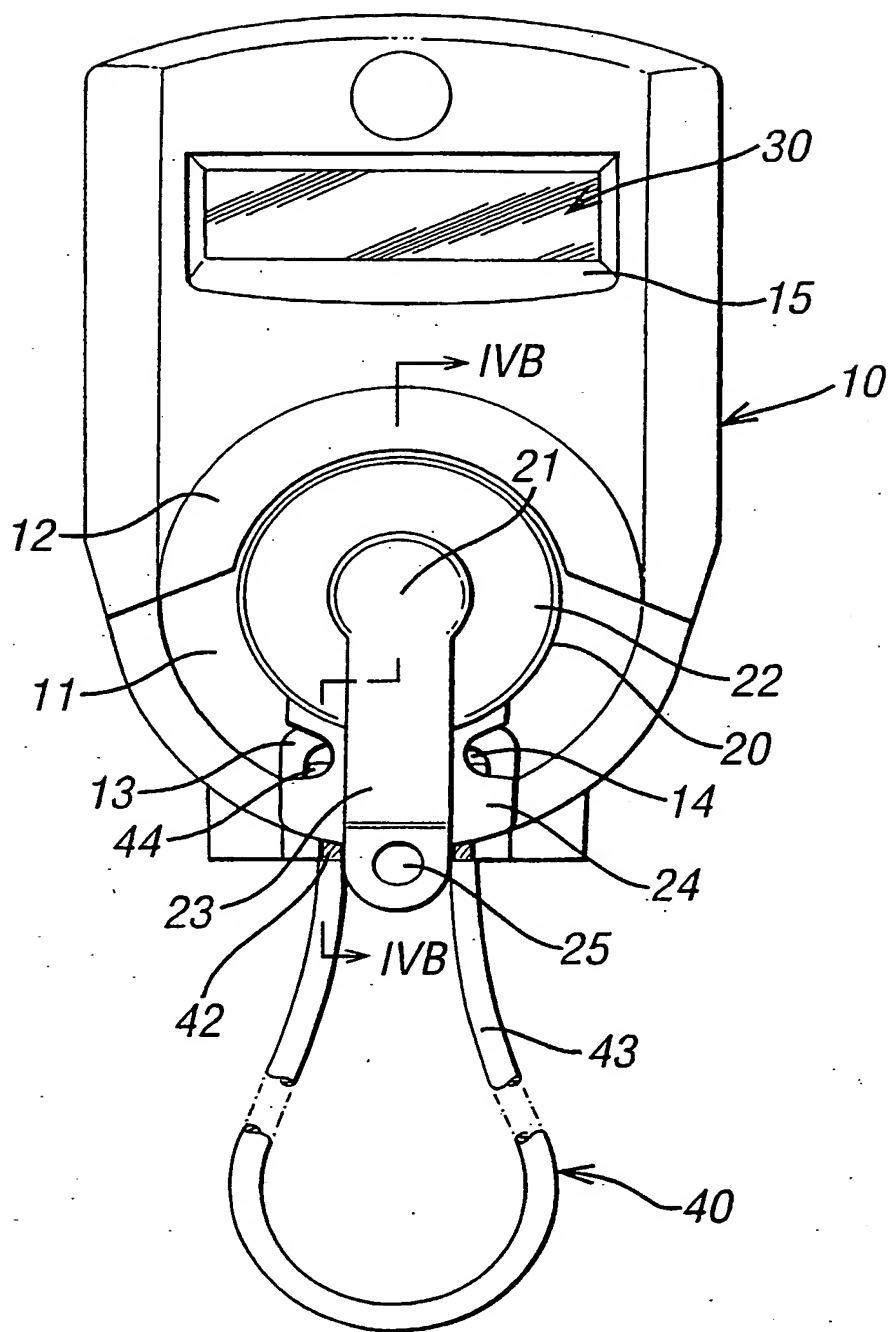


FIG. 2

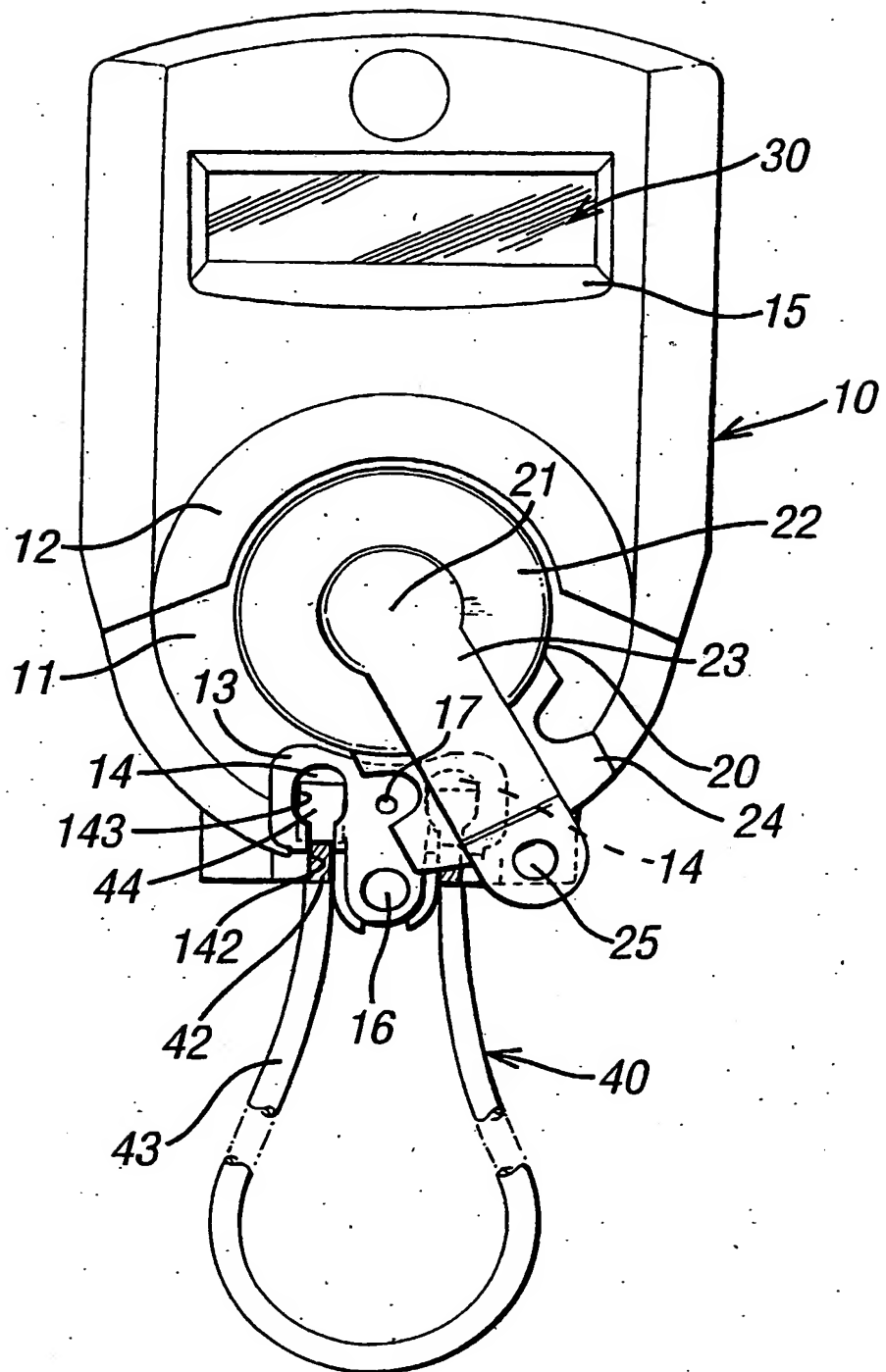


FIG. 3

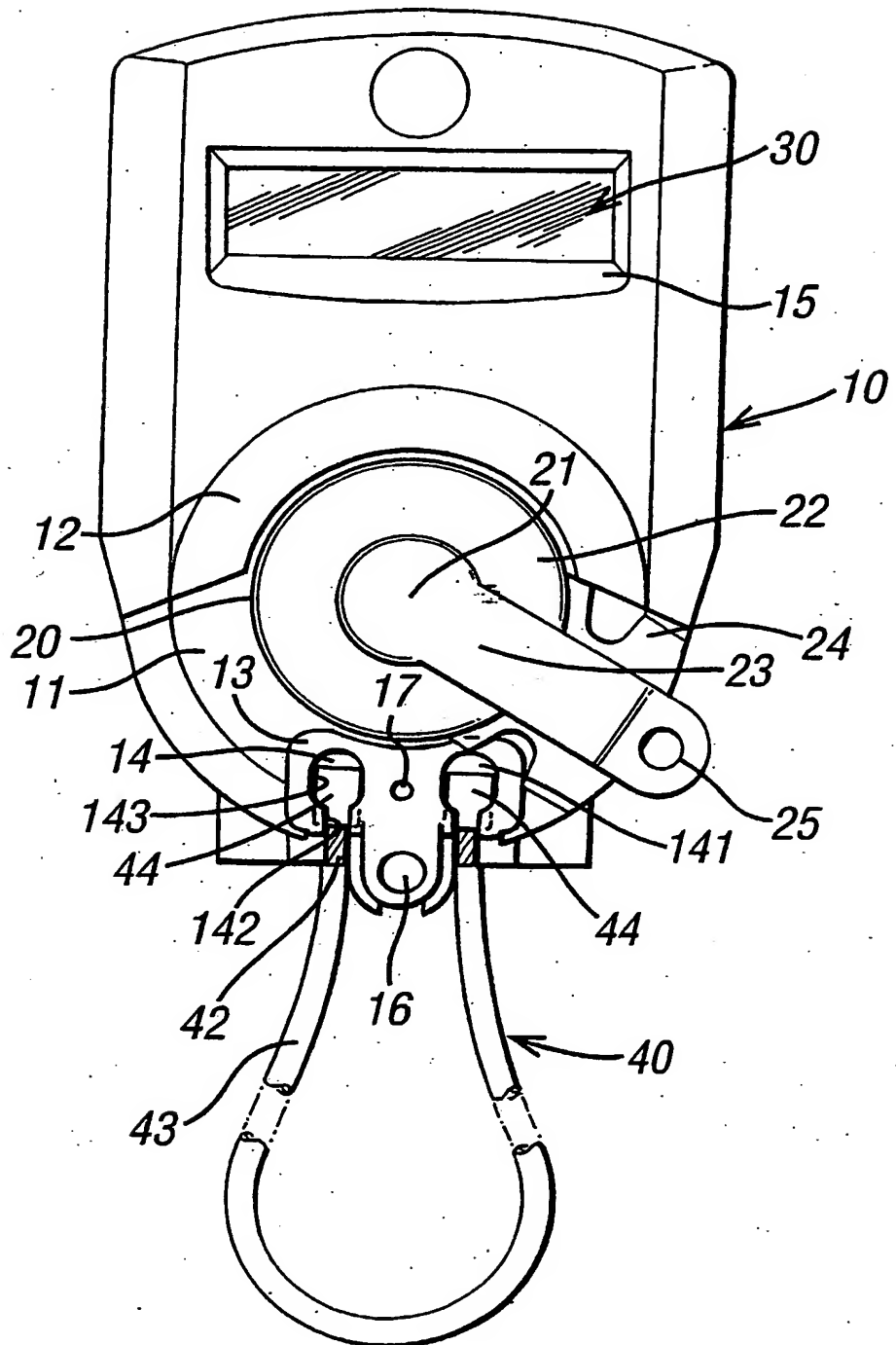


FIG. 4A.

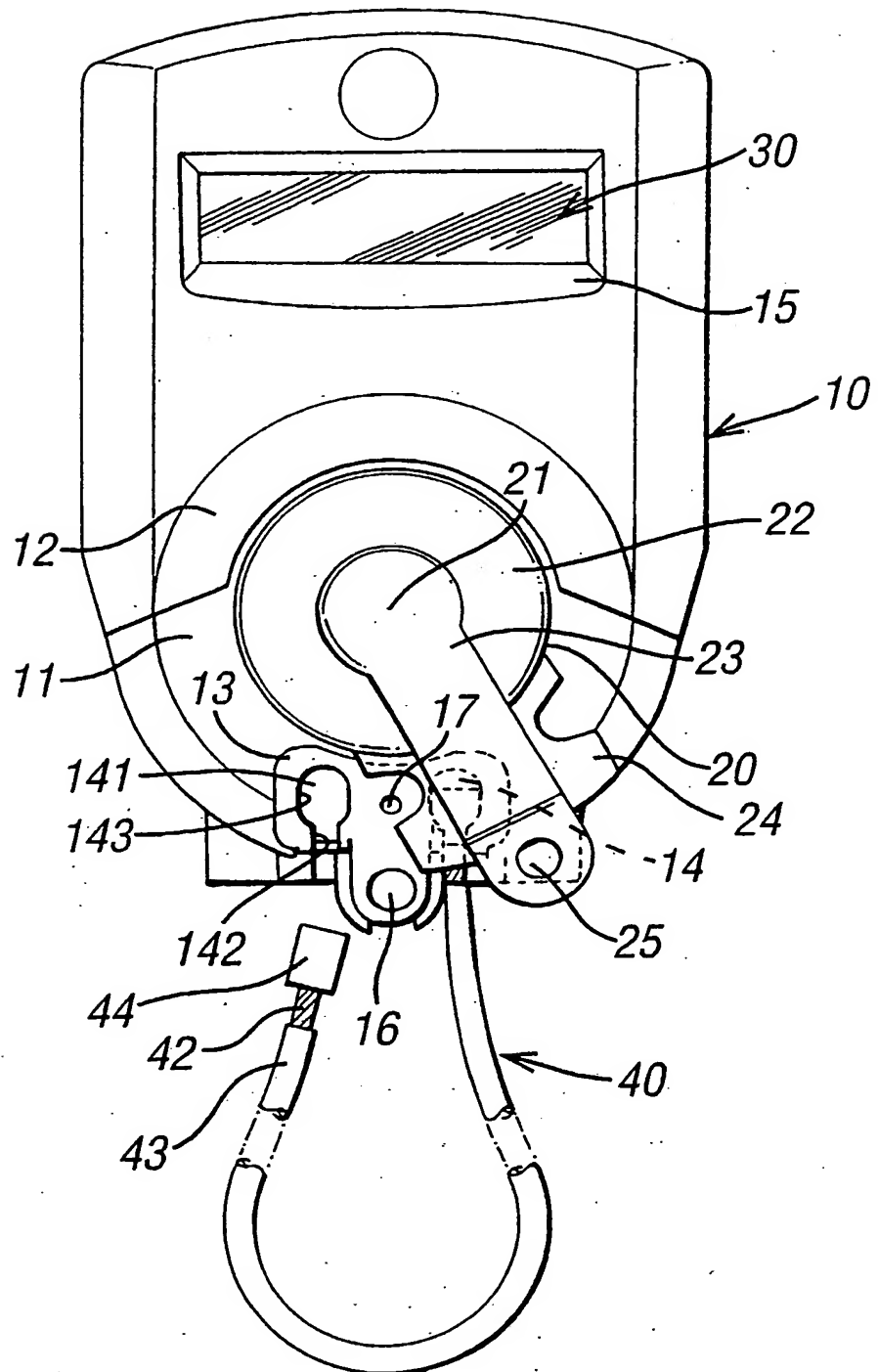


FIG. 4B

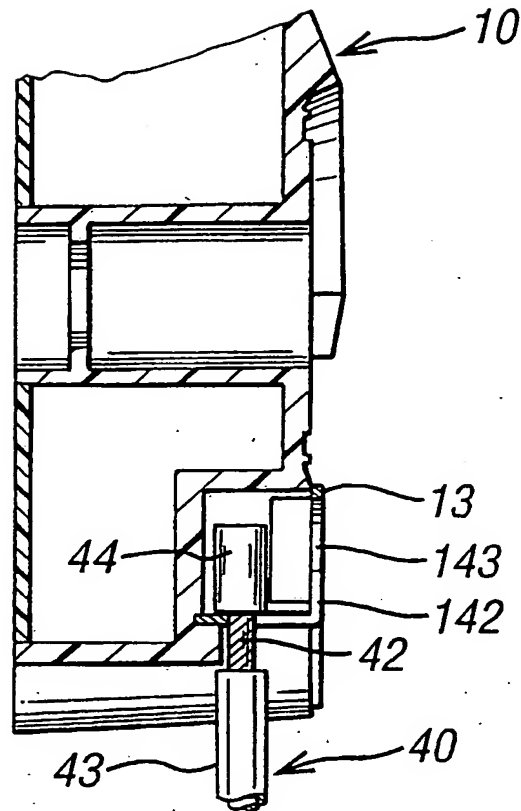


FIG. 4C

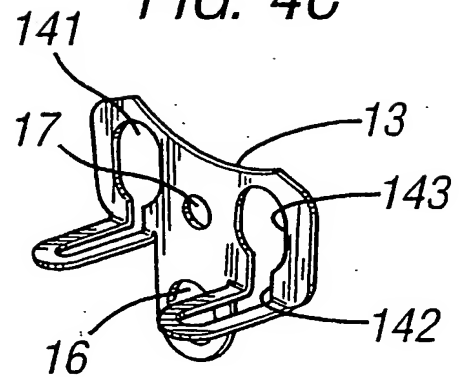
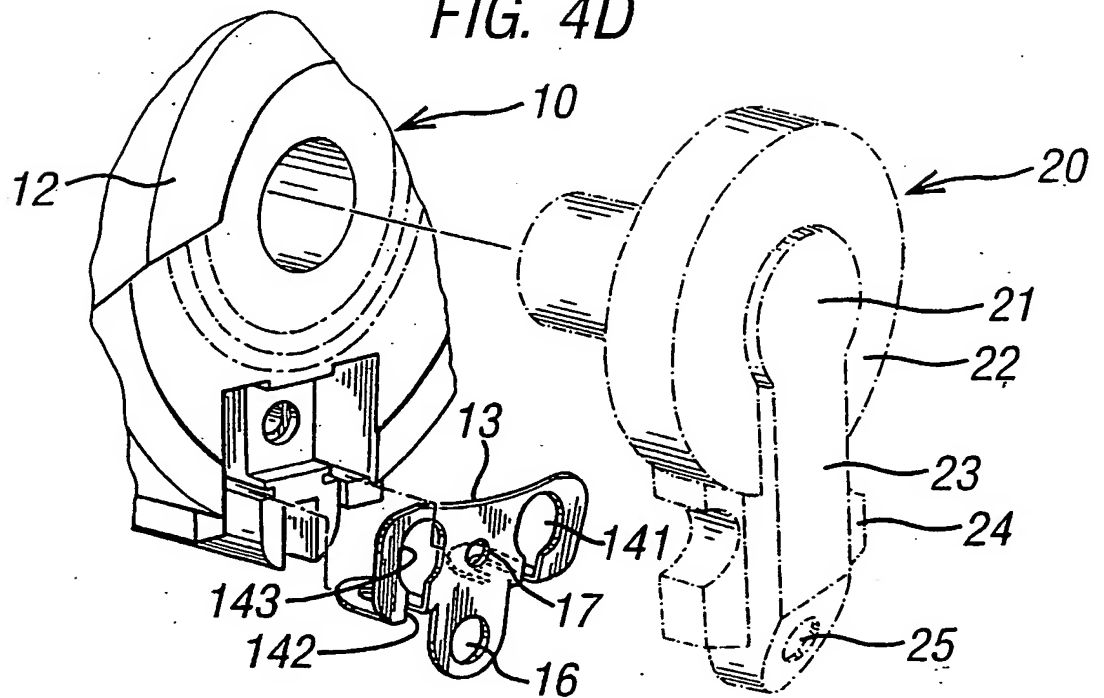


FIG. 4D



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FIG. 5

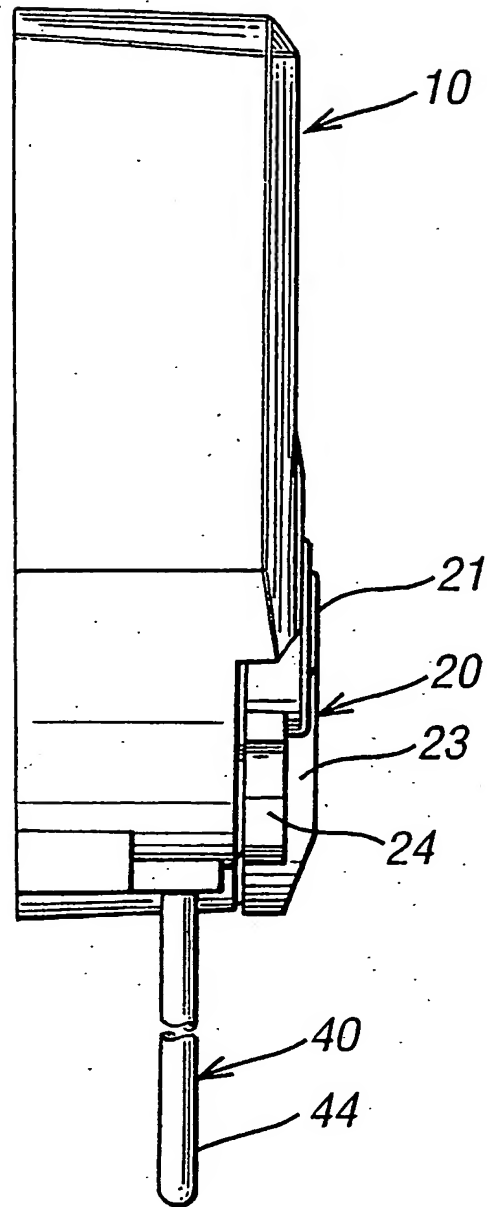


FIG. 6

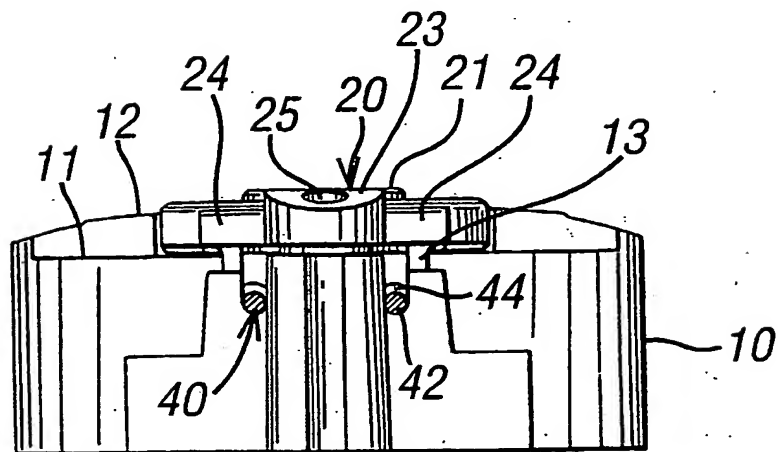


FIG. 7

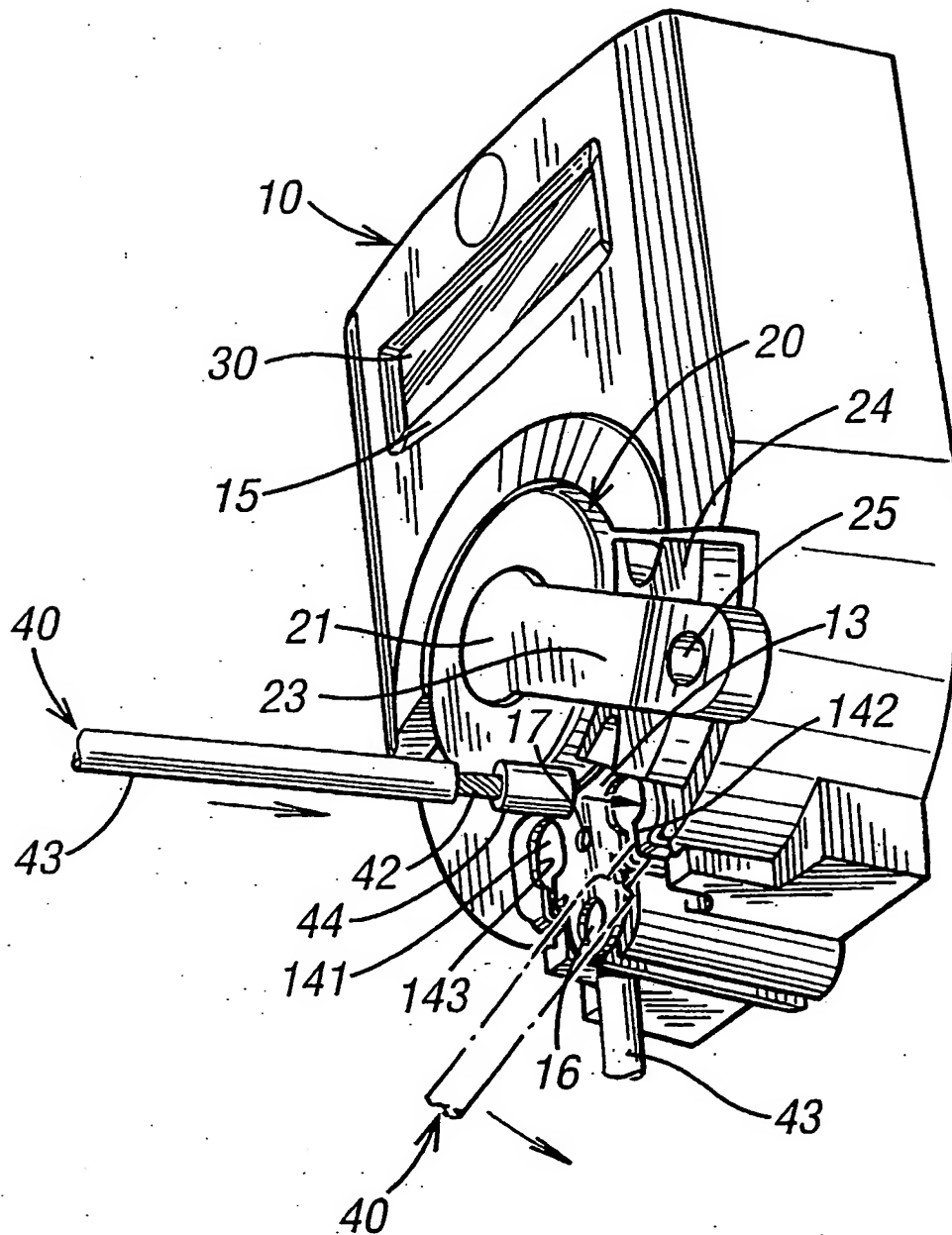
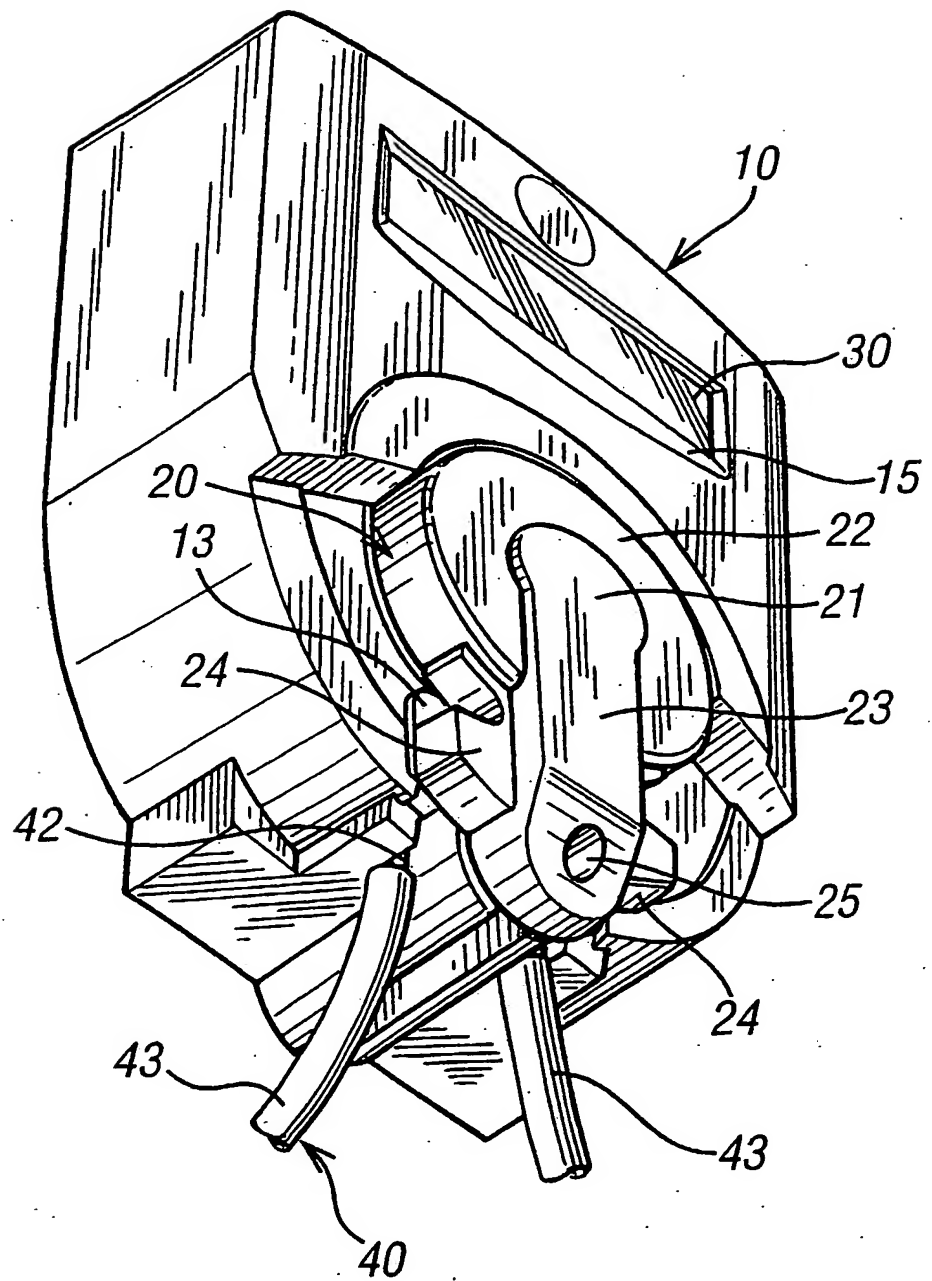


FIG. 8



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